

(12) UK Patent Application (19) GB (11) 2 238 460 (13) A

(43) Date of A publication 05.06.1991

(21) Application No 9024064.9

(22) Date of filing 06.11.1990

(30) Priority data

(31) 8925020

(32) 06.11.1989

(33) GB

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(51) INT CL⁵

F41H 1/02, B32B 3/16

(52) UK CL (Edition K)

A3V V1A5A V7AX

**B5N N0316 N0328 N0506 N0518 N0526 N0528
N0708 N0712 N1500 N1520 N1702 N1704 N175
N176 N177 N178 N18X N180 N181 N195 N196
N199 N20Y N200 N204 N205 N206 N207 N21X
N21Y N223 N224 N226 N245 N255 N2702 N2728
N2730 N2732 N2734 N281 N283 N32Y N389 N401
N418 N42Y N420 N423 N428 N46X N480 N484
N494 N513 N515 N516 N519 N539 N593 N595
N596 N70X N71X N71Y N710 N711 N712 N718
N72Y N722 N728 N729 N764 N770
U1S S1140 S3042**

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(58) Field of search

UK CL (Edition K) A3V

INT CL⁵ A41D 13/00, F41H 1/00 1/02 5/00 5/04 5/08

(54) **Protective material for body armour**

(57) A protective material (4) for protection against sharp instruments (eg an attack by a knife) comprising at least one layer of a flexible armour material (1) itself comprised of flexibly linked overlapping plates or platelets (2) and one or more layers of anti-ballistic fabric (5). Staples (6) may hold the assembly together. The plates may be of metal, ceramics, plastics or fibre reinforced plastics. The fabric (5) may be multi-layered Kevlar (RTM). Other layers may include layers of parallel textile fabric within an intervening layer of fibres perpendicular to said parallel layers – see layer (7) figure 4.

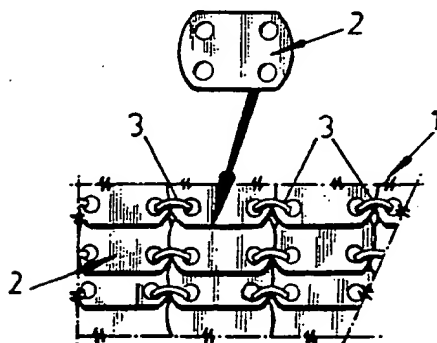


FIG. 1

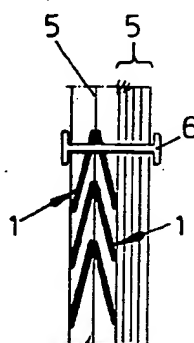


FIG. 3

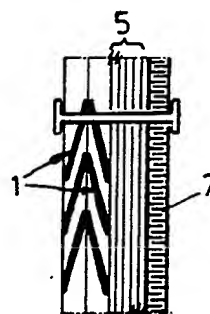


FIG. 4

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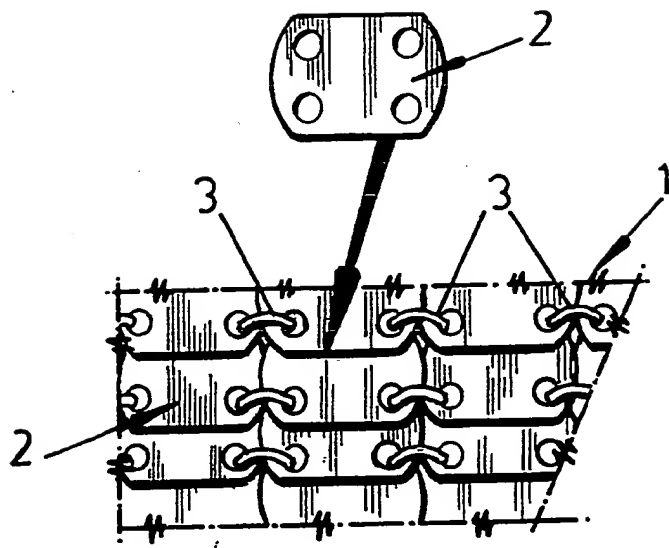


FIG. 1

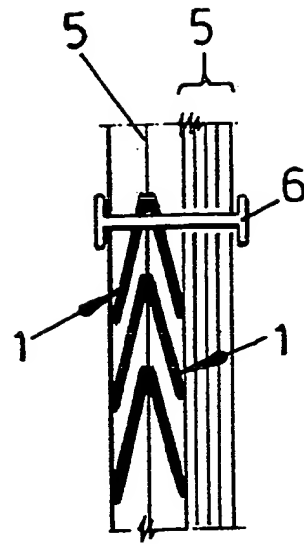


FIG. 3

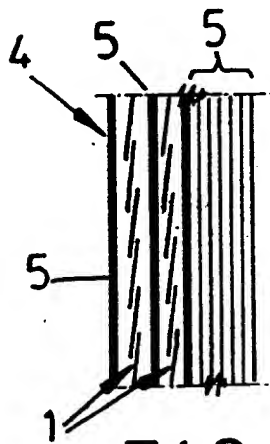


FIG. 2

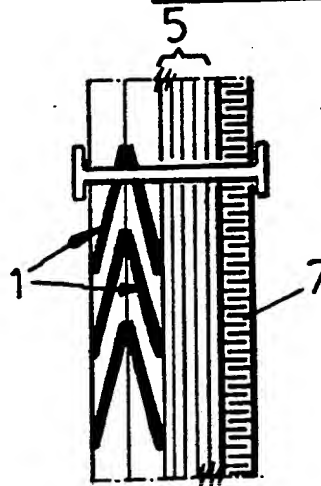


FIG. 4

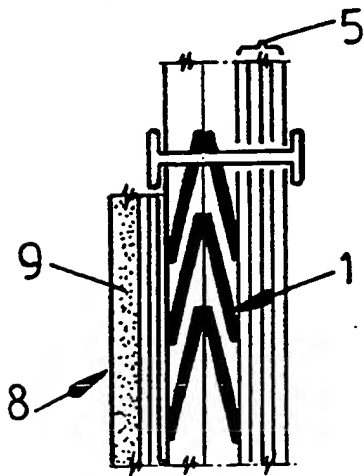


FIG. 5

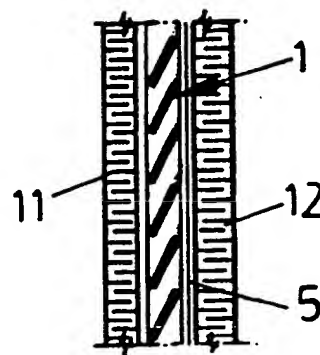


FIG. 6

PROTECTIVE MATERIAL

The present invention relates to a protective material.

The police, and other law enforcement personnel, require protection against weapons with which they may be attacked during the execution of their duty. For example, the personnel may have body armour for providing protection against a ballistic projectile. Such armour will generally comprise a number of layers of a ballistic fabric (eg. KEVLAR - Registered Trade Mark) and whilst the armour is perfectly satisfactory for resisting ballistic projectiles, it may not resist penetration by a knife in the event of an attack by stabbing on the officer.

It is therefore an object of the present invention to provide a material which is resistant to attack by stabbing.

According to the present invention there is provided a protective material for resisting attack by stabbing comprising at least one layer of a flexible armour material itself comprised of flexibly linked overlapping plates or platelets and at least one layer of an anti-ballistic fabric fixed to said armour material.

The plates or platelets of the flexible armour material are preferably of metal, plastics material, a resin impregnated material or a ceramic material. The platelets may for example be of a modified acrylic resin but most preferably are of metal.

The plates or platelets may be linked by rings (preferably of metal) so that the armour material is flexible in three dimensions. Alternatively, the plates or platelets may be linked together by rivets, staples, thread, cord or fabric hinges so as to provide for three dimensional flexibility of the armour material. The flexible armour material may be that available under the name SUPER LAMEX or ULTRA

LAMEX. ("LAMEX" is a registered Trade Mark).

The anti-ballistic fabric may be a woven, knitted or felt construction. The anti-ballistic fabric may be formed from fibres of aramid, polyethylene, glass, polypropylene, polybenzothiazole, nylon or polyamide.

Preferably, the anti-ballistic fabric is of an aramid material, for example KEVLAR. Further examples of anti-ballistic material which may be used are DYNEEMA SK60 or SPECTRA. ("DYNEEMA" and "SPECTRA" are registered Trade Marks).

The flexible armour material is preferably affixed to the anti-ballistic fabric, eg. by adhesive bonding, sewing, or by the use of flexible staples.

The protective material may comprise at least two layers of the flexible armour material between which is a layer of the anti-ballist fabric. Preferably these layers of the flexible armour material have their overlaps arranged in opposite directions. Such an arrangement insures that, in the event of a knife being able to "slip between" plates or platelets of one layer of the flexible armour, further passage of the knife will be prevented by the second layer.

The protective material may additionally be associated with a composite material which comprises a plurality of parallel layers of textile fabric and at least one further layer composed of fibres which are substantially perpendicular to the plurality of layers of textile fabric. Such a material is referred to herein for convenience as "double cloth" and is disclosed in UK-A-2 232 063. The "double cloth" may serve as a trauma pack for the protective material. The fibres of the "double cloth" may be impregnated with a resin, elastomeric material, rubber or polyamide material to restrict the movement of the fibres. Alternatively the fibres of the "double cloth" may be heat treated. Similar treatments may be applied to fibres of the anti-ballistic material.

The "double cloth" may be fixed to the anti-

ballistic fabric, for example by adhesive bonding or by sewing.

The protective material may also be associated with an anti-ballistic composite plate of known construction eg. comprising ceramic, glass or metal. The use of such a plate is particularly advantageous in cases where protection from ballistic projectiles is required as well as from sharp implements.

The protective material of the invention may be made up into a protective garment to be worn, for example, by a law enforcement officer.

The invention will be further described by way of example only with reference to the accompanying drawings, in which:

Fig. 1 is a view of a flexible armour material which may be used in the protective material according to the invention;

Fig. 2 is a schematic sectional view of one embodiment of protective material in accordance with the invention; and Figs.4-7 are similar to Fig.2 but illustrate further constructions in accordance with the invention.

The armour material 1 illustrated in Fig. 1 is of a chain mail type structure and comprises a plurality of overlapping thin aluminium plates 2 linked together by stainless steel rings 3. The thinness of the plates 2, together with the way in which they are linked by the rings 3, ensures that the material 1 is flexible. The material 1 may be of the type available from Metal Chainex (Paris, France) under the name SUPER LAMEX or ULTRA LAMEX.

Referring now to Fig. 2 there is illustrated (in schematic sectional view) one embodiment of protective material 4 in accordance with the invention which comprises two layers of armour material 1 in combination with a total of nine layers of an anti-ballistic fabric 5 (eg. KEVLAR). More particularly

the illustrated material comprises (as viewed from left to right in the Figure) a layer of anti-ballistic fabric 5, a layer of armour material 1, a further layer of fabric 5, a further layer of armour material 1, and seven further layers of anti-ballistic fabric 5. When the material is worn by an officer, the left hand layer of fabric 5 will generally be the outermost layer of the protective material.

The layers 1 and 5 may be fixed together in any suitable way. For example, the layers may all be stitched together (the stitching through layer 1 passing through the holes in the plates 2 through which the rings 3 pass). Alternatively, the various layers could be adhesively bonded together. If desired, adjacent layers of anti-ballistic fabric may be secured together (eg. by stitching or adhesive bonding) before assembly into the protective material.

The illustrated protective material has been tested for resistance to stabbing and has been found to meet the minimum requirement of the UK Police test in that the material is resistant to 42 Joules of energy from a knife blade fired from an air gun to simulate a stab attack.

Thus the material combines the advantage of being resistant to stabbing with being flexible to wear when made up into a garment, eg. a jacket or a vest.

A number of modifications may be made to the material illustrated in Fig.2. Thus, it may be possible for there only to be one layer of armour material 1 and one layer of anti-ballistic fabric 4. Such an arrangement may be suitable where the material is to be worn in combination with conventional body armour. Obviously any other combination of layers 1 and 4 may be used.

In the arrangement of Fig.3, two layers of armour material 1 are provided and arranged with their overlaps in opposite directions. In the event of a

knife thrust from (say) the left which penetrates upwardly between two of the platelets of the left hand armour layer 1, further penetration of the knife is prevented by the oppositely angled platelets of the right hand layer 1.

In the arrangement of Fig.3, a plastics staple 6 is shown as penetrating through the various layers 1 and 5. For preference, these staples 6 are provided around the edge of the material, rather than being the means by which the layers 1 and 5 are secured together throughout their areas.

In the arrangement of Fig.4, the protective material incorporates a layer of "double cloth" 7 as disclosed in UK-A-2 232 063 which serves as a trauma pack.

The arrangement of Fig.5 incorporates a high velocity pack 8 which incorporates a standard ballistic plate 9 faced with Kevlar layers 10. The provision of the high velocity pack 10 ensures that the material shown in Fig.6 may be used for protection against ballistic projectiles as well as sharp implements such as knives.

The material shown in Fig.6 comprises a single layer of armour material 1, a single layer of anti-ballistic fabric 5, and two layers of "double cloth" 11 and 12, the rear one 12, of which acts as a trauma pack. The front layer of "double cloth" may be impregnated with a resin, eg. Modar, which enhances resistance of the "double cloth" layer to penetration by a knife. The amount of resin applied should be such that the "double cloth" retains an element of flexibility.

In a modification of the above described structures, the two armour layers 1 may be of different materials. Furthermore, the illustrated constructions of protective material may be provided within a fabric cover.

CLAIMS

1. A protective material for protection against sharp instruments comprising at least one layer of a flexible armour material itself comprised of flexibly linked overlapping plates or platelets and one or more layers of anti-ballistic fabric.
2. A protective material as claimed in claim 1 wherein the plates or platelets are of metal, a plastics material, a resin impregnated material or a ceramic material.
3. A protective material as claimed in claim 1 or 2 wherein the plates or platelets are linked by rings, (preferably of metal) so that the armour material is flexible in three dimensions.
4. A protective material as claimed in claim 1 or 2 wherein the platelets are linked together by rivets, staples, thread, cord or fabric hinges so that the armour material is flexible in three dimensions.
5. A protective material as claimed in any one of claims 1 to 4 wherein the anti-ballistic fabric is a woven, knitted or felt construction.
6. A protective material as claimed in any one of claims 1 to 5 wherein the anti-ballistic fabric is formed from fibres of aramid, polyethylene, glass, polypropylene, polybenzothiazole, or polyamide.
7. A protective material as claimed in any one of claims 1 to 6 wherein the flexible armour

material is affixed to the anti-ballistic fabric.

8. A protective material as claimed in claim 7 wherein the flexible armour material is affixed to the anti-ballistic fabric by adhesive bonding, sewing, or stapling.
9. A protective material as claimed in any one of claims 1 to 8 comprising at least two layers of the armour material between which is a layer of said anti-ballistic fabric.
10. A protective material as claimed in any one of claims 1 to 9 comprising two layers of the flexible armour material arranged with their overlaps in opposite directions.
11. A protective material according to any one of the preceding claims incorporating at least one layer of material composed of fibres which are substantially perpendicular to the layer or layers of anti-ballistic fabric.
12. A protective material as claimed in any one of claims 1 to 11 additionally provided with a trauma pack.
13. A protective material as claimed in any one of claims 1 to 11 provided with an anti-ballistic composite plate, for example of ceramic, glass or metal.
14. A protective material according to any one of the preceding claims wherein the ballistic fabric is comprised of fibres which are heat treated.

15. A protective material according to any one of claims 1 to 13 wherein the ballistic fabric is comprised of resin impregnated or rubber impregnated fibres.
16. A protective material as claimed in any one of claims 1 to 15 wherein the ballistic fabric is faced with a plastics material.
17. A protective material as claimed in any one of claims 1 to 16 incorporating a closed-cell foam material for buoyancy.
18. A protective material as claimed in claim 11 wherein said at least one layer of material is composed of heat treated fibres.
19. A protective material as claimed in any one of claims 1 to 18 having a fabric cover.
20. A protective material substantially as hereinbefore described with reference to any one of Figs.1 to 6 of the accompanying drawings.
21. A shield comprising a protective material according to any one of claims 1 to 19.

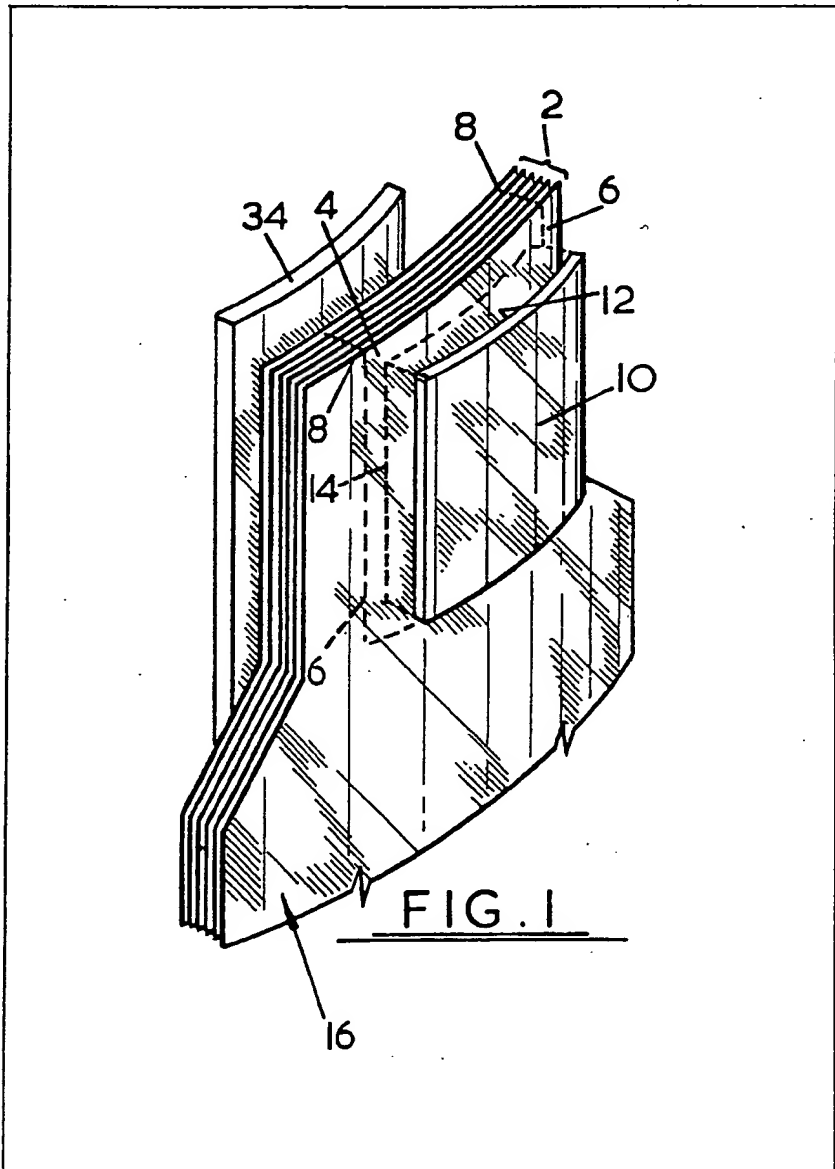
(12) UK Patent Application (19) GB (11) 2 130 073 A

- (21) Application No 8232227
 (22) Date of filing 11 Nov 1982
 (43) Application published
 31 May 1984
 (51) INT CL³
 F41H 1/02 B32B 1/04
 7/02
 (52) Domestic classification
 A3V 1A5A 5M2B 7AX 7B1
 B5N 0104 0702
 U1S 1140 B5N
 (56) Documents cited
 GBA 2090725
 GBA 2061089
 (58) Field of search
 A3V
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(54) Protective shield

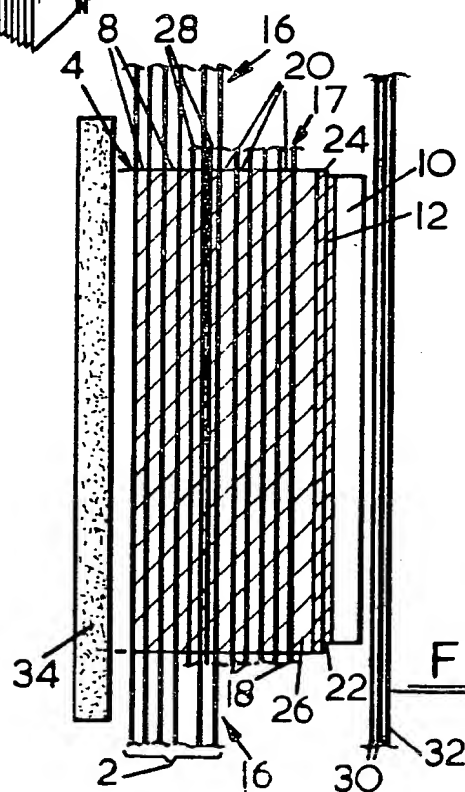
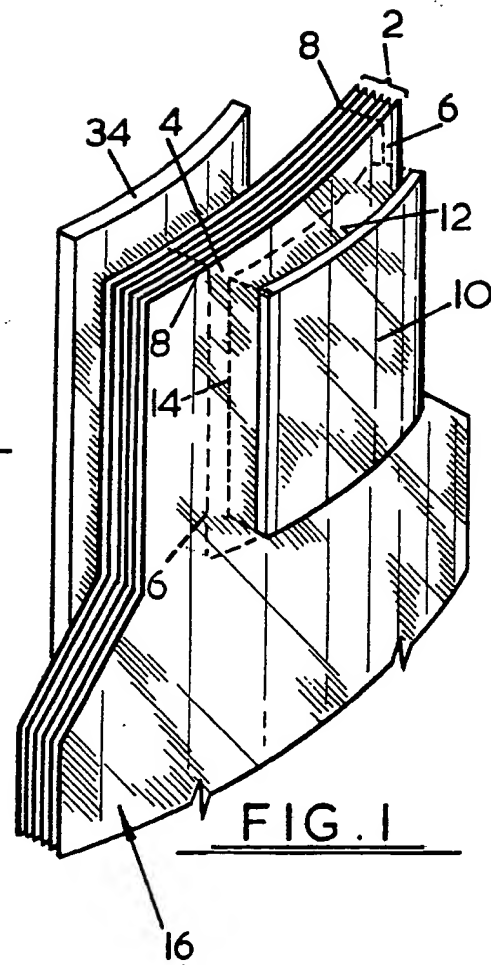
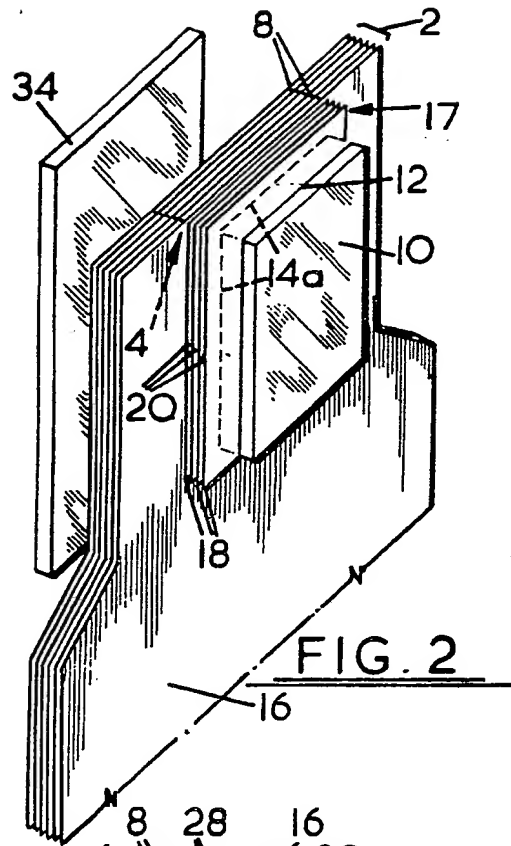
(57) A protective shield which in use is disposed before a person or thing to be protected from injury by a bullet or other missile, includes a plurality of layers 2 of woven aramid fabric adhesively bonded together at 8 to form a stiff region 4 having an area boundary at 6. At the front of the stiff region 4 an anti-ballistic ceramic tile

10 is bonded thereto so that over the whole of its rear face 12 the tile is supported by the stiff region. If desired an adhesively mounted metal plate and/or an additional stiff support of adhesively bonded aramid or glass fibre layers can be disposed between the region 4 and the tile. The shield can include a trauma pack 34, and be formed as or be incorporated in a garment for wear as body armour.



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SPECIFICATION Protective shield

This invention concerns a protective shield which in use is disposed before a person or thing to be protected from injury or damage by a bullet or other missile, for example, flying fragments of metal or other hard material.

The invention has a particular but not exclusive application to protective shields forming body armour which is in the nature of clothing, sometimes called bullet-proof clothing.

Known body armour comprises superposed layers of anti-ballistic textile fabric which in the nature of clothing is flexible and adapts to the body shape of the person wearing the armour. Known body armour has external pockets loosely containing anti-ballistic plates to provide enhanced protection for vital organs. For example, a plate may be located in front of the chest. The or each plate can be a composite formed by an anti-ballistic ceramic tile having a backing of aramid or glass fibre material. When the armour is worn the fabric layers, in adopting the body shape, take on a curved shape to which a flat plate extends tangentially. Thus, there are large portions of the rear face of the flat plate which face the fabric layers but are not in contact therewith. For example, quite wide marginal strips of the rear face are spaced from the fabric layers, and so those strips are unsupported. This means that a bullet striking a part of the front face of the plate opposite such an unsupported strip has a greater chance of shattering the tile in a manner which increases the risk of the bullet passing through the remainder of the armour behind the plate, to injure the person. To reduce this risk, plates incorporating tiles of curved cross-section have been used. That curvature for a given plate is fixed and may not be complementary to the curvature of the textile layers in armour worn by any particular person. So again parts of the plate are spaced from the layers and are thus unsupported. Therefore the defect occurring when the plate is flat can also occur when the plate is curved. Furthermore, when the armour is being tested, for its bullet stopping effectiveness, it is often spread over a sand-bag which causes the fabric layers to lie flat and become spaced from the central part of the curved plate. This results in the central part of the plate being more liable to shatter in a manner admitting greater penetration of the armour than would probably occur when the armour is being worn. Therefore the result of the test can give an unfairly low estimation of what the true effectiveness of the armour would be when in actual use. Another disadvantage of the known body armour is that the loose plate may be disposed wrong way round in the pocket, or the plate may get lost. Both of these can have disastrous consequences for the person wearing the armour.

An object of the invention is to provide a protective shield which if used as body armour avoids or at least mitigates the aforementioned

disadvantages, but which shield is not necessarily limited to usage as body armour.

According to the invention a protective shield which in use is disposed before a person or thing to be protected from injury by a bullet or other missile, comprises an anti-ballistic ceramic tile, a plurality of superposed layers of anti-ballistic textile fabric which when the shield is in use are disposed between the person or thing being protected and the tile, portions of at least some of said layers being adhesively bonded together to form a stiff region to which the tile is attached and supported by said region over an area at least substantially equal to the whole of that face of the tile facing the layers and one or more layers of the fabric extending beyond said region forming a flexible arrangement to adapt to a non-planar shape against which the flexible arrangement may be placed when the shield is in use.

The anti-ballistic textile fabric, which may be woven can be formed from aramid fibres.

The anti-ballistic ceramic tile may be of hard-brittle material and may be any kind known per se. For example, the tile may be formed from alumina, silicon carbide, or boron carbide. The tile may have a hardness in the range of 2000 to 3500 Kg/mm² and a rupture modulus in excess of 400 MN/m². The alumina tile may be of SINTOX (Trade Mark) sold by Smiths Industries Limited.

The tile may be flat or may be non-planar and have a shaped, for example, curved, cross-section. If desired a plurality of tiles may be used. In this latter case the tiles may be relatively small, and may be disposed side by side to form a larger relatively continuous tiled area.

To reinforce the support provided by the stiff region a plate of metal which may be hard may be disposed between the tile and the stiff region and held in place by adhesive. The metal may be steel which may be hardened, aluminium alloy, or titanium. The plate may extend over at least substantially the whole of the area of the face of the tile facing the stiff region.

To augment the support provided by the stiff region, a stiff additional support may be provided adhered to the stiff region and interposed between the tile and region. This additional support may have an area facing the tile at least substantially equal to that of the tile face. The additional support may comprise further superposed layers of anti-ballistic materials adhered together. The further layers may be of or comprise fibres, for example, one or more of the layers may be of aramid or glass fibres, which may be in the form of a textile fabric which may be woven. If desired one or more of such further layers may be interposed between the first-mentioned layers adhered to form the stiff region.

The aramid fibres used have high tensile strength and high stretch resistance. The aramid fabric which can be closely or relatively coarsely woven may be formed of aramid fibre KEVLAR 29 or KEVLAR 49 (Trade Mark of Du Pont) sold by Fothergill & Harvey Limited under their reference D235 and D208 respectively.

The KEVLAR 29 fabric may weigh about 279 gm/m², be about 0.38 mm thick and be of plain weave from warp to weft ends each of about 12.2 per cm, the yarn used being about 1110 decitex.

The KEVLAR 49 fabric may weigh about 218 gm/m², be about 0.33 mm thick, be of plain weave from warp and weft ends each of about 6.7 per cm, the yarn used being about 1580 decitex.

The superposed layers of aramid fabric may be a mixture of KEVLAR 29 and KEVLAR 49 fabrics.

The adhesive(s) used to bond the aforesaid superposed layers and the tile and plate may be of any suitable kind in an adhesive process of any appropriate type.

Liquid or powder adhesive may be used to bond together the superposed layers. The bonding may be by "wet-lay-up" or the layers may be in prepreg form with the adhesive activated by heat and/or other means. Contact adhesive or hot melt adhesive may be used. If desired, the adhesive may be of synthetic resin type, for example, polyester or epoxy resins. The adhesive may also be of a rubber material for example, silicone rubber. If desired the superposed layers may be subjected to pressure during bonding.

The protective shield may be used as or in body armour so the flexible arrangement adopts to the shape of the body of the person wearing the armour. For example, the shield may or form part of a vest or other garment for wear. In the case of body armour a cushion or trauma pack may be provided between the person's body and the layers of anti-ballistic material. The trauma pack may comprise felt for example, a needle pucked felted fabric which may be nylon, and one or more layers of other fabric, for example, aramid fabric which may be as described above.

The protective shield may be placed against objects to protect the latter in which case the flexible arrangement can adopt the shape of the object to fit closely thereto.

One or more layers of the aramid fibre fabric may be disposed in front of the tile, and/or at least one layer of a continuous plastics sheet material may be disposed before the tile. The shield may be in a waterproof cover.

In the flexible arrangement portion(s) of the shield, some or all of the superposed layers may be connected together at intervals in any suitable manner which does not substantially prevent flexibility, for example, by rows of stitching, rivets, staples or of small spots of adhesive.

The invention will now be further described, by way of example, with reference to the accompanying drawings in which:

Fig. 1 is a diagrammatic and partly exploded view of a protective shield formed according to the invention;

Fig. 2 is a diagrammatic and partly exploded view of another embodiment of protective shield formed according to the invention, and

Fig. 3 is a diagrammatic and partly exploded view of a further embodiment of protective shield formed according to the invention.

In the drawings like references refer to like parts.

In Fig. 1, the shield comprises several superposed layers of woven aramid fabric 2 which at the region 4 outlined by dotted line 6 are adhesively bonded together using adhesive 8 so that region 4 is a substantially solid stiff mass supporting an anti-ballistic ceramic tile 10. In Fig. 1 the tile is curved. The whole of its rear face 12 is adhered to the region 4, which, as indicated by outline 14 of the tile thereon, is of greater size than the tile face 12 which is adhered to the stiff region. The portion 16, of the combination of the layers 2 extending beyond the region 4 is a flexible arrangement which can adapt to a shape against which the shield is placed.

In Fig. 2 the tile 10 is flat. Over the stiff region 4 of the bonded layers 2 is an additional support 17 formed by bonded superposed layers 18 of anti-ballistic material forming a substantially solid stiff mass bonded to region 4. The layers 18 may be of the same or different materials, for example aramid fabric or glass fibre fabric or web. The adhesive bonding material is shown at 20. The outline of the tile 10 bonded to the frontmost layer 18 is shown at 14a.

In Fig. 3 the tile 10 is adhesively bonded at 22 to a metal plate 24 bonded at 26 to the additional support 17. Between at least some of the layers 2 in the stiff region 4 are further layers 28 of anti-ballistic material. These layers 28 may be of the same or different materials, for example, aramid fabric or glass fibre fabric or web.

If desired one or more further layers 30 of aramid fabric may be disposed in front of the tile 10. Also a continuous plastics sheet 32 may be disposed in front of the tile 10 (and preferably in front of layers 30) to reduce spall of a missile striking the shield. It being understood that along the direction of travel of a missile to the shield, the tile 10 is in front of the layers 2.

When the shield is used as or incorporated in body armour, a trauma pack 34 may be provided.

When the shield is used in or as body armour, the tile is preferably disposed in front of a particularly vulnerable part of the body, for example, the chest, to protect one or more vital organs.

In addition to the complete support provided by the stiff portion for the tile and the ability of the integral flexible arrangement to adapt to the shape against which it is placed, an advantage of the shield is that the armour to defeat specific high-velocity threats on the tile and low-velocity threats on the flexible arrangement can be determined exactly without the need for excess and redundant ballistic materials within the armour, thus having a saving on weight and cost.

Another advantage of the shield where the support provided for the tile by the stiff portion behind the tile dissipates the remaining kinetic energy from the fragmented impacting bullet or missile, is that this energy is absorbed not only by the high tensile strength of the fibres but by two or more of the bonded layers splitting apart or de-

laminating. For the tile to sustain multi-hits from high velocity missiles it is advantageous that de-lamination is confined to substantially the region directly behind each different part of the tile struck by respective impacting bullets or missiles. The complete support provided by the total adhered mass of the stiff portion further assists the rigid tile around the cone of these impact forces. The rate and extent of de-lamination of the aramid and/or fibre glass layers can be controlled to some extent by the amount and nature of the adhesive and the bond. Thus in an embodiment of the shield formed according to the invention there may be more than one type of adhesive or bonding agent in the make-up of the stiff portion behind the tile.

Another advantage of the shield in accordance with the invention over previously known body armour is that the tile cannot be lost nor when the shield is used in body armour can the tile be located wrong way round when the armour is being worn.

A further advantage of the shield when used as body armour is that it requires fewer waterproof bags and less pockets to contain plates than previously known flexible body armour.

CLAIMS

1. A protective shield which in use is disposed before a person or thing to be protected from injury or other missile, comprising an anti-ballistic ceramic tile, a plurality of superposed layers of anti-ballistic textile fabric which when the shield is in use are disposed between the person or thing being protected and the tile, portions of at least some of said layers being adhesively bonded together to form a stiff region to which the tile is attached and supported by said region over an area at least substantially equal to the whole of that face of the tile facing the layers, and one or more layers of the fabric extending beyond said stiff region forming a flexible arrangement to adapt to a non-planar shape against which the flexible arrangement may be placed when the shield is in use.

2. A shield as claimed in claim 1, in which the textile fabric is aramid fabric.

3. A shield as claimed in claim 1 or claim 2, in which the tile is planar or non-planar.

4. A shield as claimed in claim 3, in which the tile is made from alumina, silicon carbide, or boron carbide.

5. A shield as claimed in any one preceding claim, in which the tile is attached in position by adhesive.

6. A shield as claimed in any one preceding claim, in which instead of said tile there is a tiled area formed by a plurality of smaller anti-ballistic tiles mounted side-by-side.

7. A shield as claimed in any one preceding claim, in which a metal plate attached in position is interposed between the tile and the stiff region.

8. A shield as claimed in claim 7, in which the plate is formed of steel, an aluminium alloy, or titanium.

9. A shield as claimed in any one preceding claim, in which a stiff additional support between the tile or tiled area and the stiff region is adhered to said stiff region, and said additional support does not extend substantially beyond the boundary of the stiff region.

10. A shield as claimed in claim 9, in which the additional support is formed of layers of anti-ballistic textile material adhesively bonded together.

11. A shield as claimed in claim 10, in which one or more of the layers of said textile material in the additional support is/are of aramid fibres or glass fibres.

12. A shield as claimed in any one preceding claim, in which one or more further layers of anti-ballistic textile material is disposed between at least some of said layers of the anti-ballistic textile fabric at said stiff region.

13. A shield as claimed in claim 12, in which one or more of said further layers is formed of aramid fibres or glass fibres.

14. A shield as claimed in any one preceding claim, in which the adhesive bonding of one of said textile layers to another adjacent thereto is different to the adhesive bonding of another said textile layer to an adjacent said textile layer.

15. A shield as claimed in any one preceding claim, in which at least one layer of aramid textile fabric is disposed in front of the tile or tiled area.

16. A shield as claimed in any one preceding claim, in which a continuous plastics sheet material is disposed in front of the tile or tiled area.

17. A shield as claimed in any one preceding claim within a water-proof cover.

18. A shield as claimed in any one preceding claim, in which a cushion or trauma pack is disposed between said superposed layers of anti-ballistic textile fabric and person or thing to be protected.

19. A shield as claimed in claim 18, in which the cushion or trauma pack comprises felt.

20. Body armour for wear in the form of a garment formed by or comprising a shield as claimed in any one preceding claim.

21. A shield as claimed in claim 1 and substantially as hereinbefore described.

New claims or amendments to claims filed on 19 Jan. '84.

Superseded claims: Claim 1.

New or amended claims:—

1. A protective shield which in use is disposed before a person or thing to be protected from injury by a bullet or other missile, comprising an anti-ballistic ceramic tile, a plurality of superposed layers of anti-ballistic textile fabric which when the shield is in use are disposed between the person or thing being protected and the tile, portions of at least some of said layers being adhesively bonded together to form a stiff region to which the tile is attached and supported by said region over an area at least substantially equal to

the whole of that face of the tile facing the layers,
and one or more layers of the fabric extending
beyond said stiff region forming a flexible

5 arrangement to adapt to a non-planar shape
against which the flexible arrangement may be
placed when the shield is in use.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1984. Published by the Patent Office,
25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.